

Application Serial No.: 10/582,813
Attorney Docket No.: 26068-27B

Examiner: D. Nguyen
Art Unit: 2818

Claims 1-11: (Canceled)

12. (Currently amended) A planar Hall effect magnetic sensor comprising:
an active area comprising a magnetic film that exhibits both planar Hall effect and
biaxial magnetic anisotropy;

a first pair of conductive leads arranged on opposing sides of the active area for
driving electrical current across the active area in a first direction; and

a second pair of conductive leads arranged on opposing sides of the active area in
a second direction perpendicular to the first direction for measuring voltage across the
active area in the second direction; and

two conductive films deposited parallel to the first pair of conductive leads and
the second pair of conductive leads and separated from the active area by one or more
insulating layers, wherein said two conductive films are used to generate a magnetic
field, and

wherein one of the conductive films is positioned above the active area of the
magnetic sensor separated from the active area by a first insulating layer and the other
conductive film is positioned below the active area of the magnetic sensor separated from
the active area by a second insulating layer.

13. (Original) The magnetic sensor according to claim 12, wherein the magnetic film
is epitaxially grown on a perovskite single crystal.

14. (Original) The magnetic sensor according to claim 13, wherein the magnetic film
is deposited on the perovskite crystal in the shape of a cross having arm portions of
approximately equal length, and the first pair of conductive leads and the second pair of
conductive leads are coated on the arm portions of the magnetic film, wherein a middle
portion of the magnetic film is left uncovered by the conductive leads.

15. (Original) The magnetic sensor according to claim 14, wherein the conductive
leads are copper.

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16. (Original) The magnetic sensor according to claim 12, wherein the magnetic film has two easy axes that are arranged perpendicular to each other and are aligned with the first pair of conductive leads and the second pair of conductive leads.

17. (Canceled)

18. (Withdrawn) The magnetic sensor according to claim 17, wherein the two conductive films overlap each other and are positioned below the active area of the magnetic sensor, separated by the insulating layer.

19. (Withdrawn) The magnetic sensor according to claim 17, wherein the two conductive films overlap each other and are positioned above the active area of the magnetic sensor, separated by the insulating layer.

20. (Canceled)

21. (Currently amended) The magnetic sensor according to claim 12[[17]], wherein the conductive film is selected from the group consisting of copper, aluminum, and gold.

22. (Currently amended) The magnetic sensor according to claim 12[[17]], wherein the one or more insulating layers are selected from the group consisting of aluminum oxides, magnesium oxides, and strontium titanite.

23. (Original) The magnetic sensor according to claim 22, wherein the one or more insulating layers are aluminum oxide.

24. (Original) The magnetic sensor according to claim 13, wherein the magnetic film is deposited on the crystal by physical vapor deposition.

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25. (Currently amended) The magnetic sensor according to claim 24[[12]], wherein the deposited film has a thickness between about 4 nm and about 100 nm.
26. (Original) The magnetic sensor according to claim 25, wherein the deposited film has a thickness between about 10 nm and about 50 nm.
27. (Original) The magnetic sensor according to claim 12, wherein the magnetic film is a manganite thin film of the formula $R_{1-x}A_xMnO_3$, wherein R is a rare-earth metal, A is an alkaline earth metal, and x is between about 0.15 and about 0.5.
28. (Original) The magnetic sensor according to claim 27, wherein the rare earth metal is lanthanum.
29. (Original) The magnetic sensor according to claim 27, wherein the alkaline earth metal is selected from the group consisting of strontium, calcium, and barium.
30. (Original) A magnetic bit cell for use in a planar Hall effect magnetoresistive random access memory (MRAM) device, the magnetic bit cell comprising:
 - an active area comprising a magnetic film that exhibits both planar Hall effect and biaxial magnetic anisotropy;
 - a first pair of conductive leads arranged on opposing sides of the active area for driving electrical current across the active area in a first direction; and
 - a second pair of conductive leads arranged on opposing sides of the active area in a second direction perpendicular to the first direction for measuring voltage across the active area in the second direction;

wherein the magnetic film is epitaxially grown on a perovskite single crystal so that easy axes of the thin film are perpendicular to each other and at a 45-degree angle relative to the direction of the current.

31. (Canceled)

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32. (Original) The magnetic bit cell according to claim 31, wherein the magnetic film is deposited on the perovskite crystal in the shape of a cross having arm portions of approximately equal length, and the first pair of conductive leads and the second pair of conductive leads are coated on the arm portions of the magnetic film, wherein a middle portion of the magnetic film is left uncovered by the conductive leads.

33. (Original) The magnetic bit cell according to claim 30, wherein the conductive leads are copper.

34. (Canceled)

35. (Original) The magnetic bit cell according to claim 30, further comprising a first write bit line and a second write bit line electrically isolated from the magnetic bit cell by an insulating layer.

36. (Original) The magnetic bit cell according to claim 35, wherein the first write bit line and the second write bit line are arranged perpendicular to each other.

37. (Withdrawn) The magnetic bit cell according to claim 36, wherein the first write bit line and the second write bit line overlap each other and are positioned below the active area of the magnetic bit cell, separated by the insulating layer.

38. (Withdrawn) The magnetic bit cell according to claim 36, wherein the first write bit line and the second write bit line overlap each other and are positioned above the active area of the magnetic bit cell, separated by the insulating layer.

39. (Original) The magnetic bit cell according to claim 36, wherein one of the write bit lines is positioned above the active area of the magnetic bit cell separated from the active area by a first insulating layer and the other write bit line is positioned below the

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active area of the magnetic bit cell separated from the active area by a second insulating layer.

40. (Original) The magnetic bit cell according to claim 35, wherein the insulating layer is an aluminum oxide or strontium titanite.

41. (Original) The magnetic bit cell according to claim 35, wherein the first write bit line and the second write bit line comprise a conductive film through which current can be passed.

42. (Original) The magnetic bit cell according to claim 41, wherein a combination of current in the first write bit line and the second write bit line generates a field that flips the magnetization between the two easy axes of the magnetic bit cell.

43. (Original) The magnetic bit cell according to claim 31, wherein the magnetic film is deposited on the crystal by physical vapor deposition.

44. (Original) The magnetic bit cell according to claim 43, wherein the deposited film has a thickness between about 4 nm and about 100 nm.

45. (Original) The magnetic bit cell according to claim 44, wherein the deposited film has a thickness between about 10 nm and about 50 nm.

46. (Original) The magnetic bit cell according to claim 30, wherein the magnetic film is a manganite thin film of the formula $R_{1-x}A_xMnO_3$, wherein R is a rare-earth metal, A is an alkaline earth metal, and x is between about 0.15 and about 0.5.

47. (Original) The magnetic bit cell according to claim 46, wherein the rare earth metal is lanthanum.

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48. (Original) The magnetic bit cell according to claim 46, wherein the alkaline earth metal is selected from the group consisting of strontium, calcium, and barium.

Claims 49-56: (Canceled)